

Please **AMEND** the claims as follows:

Please **CANCEL** claims 20 and 21.

1. (Currently Amended) A method of implementing storage virtualization on a network device of a storage area network, the method comprising:

(a) receiving a frame or packet at a port of the network device, wherein the network device is a switch, router, iSCSI gateway, or other network node configured to perform a switching function, wherein the frame or packet received at the port of the network device includes a read or write command;

(b) determining that the frame or packet pertains to access of a virtual storage location of a virtual storage unit representing one or more physical storage locations on one or more physical storage units of the storage area network, wherein the virtual storage unit comprises a VLUN or other virtual representation of storage on the storage area network;

(c) obtaining a virtual-physical mapping between the one or more physical storage locations and the virtual storage location;

(d) sending a new or modified frame or packet to an initiator or a target specified by the virtual-physical mapping; and

(e) requesting a lock of the one or more physical storage locations by said port of the network device prior to submitting a read or write command to the one or more physical storage locations, wherein requesting a lock of the one or more physical storage locations includes sending a lock request to a single master port of a network device within the storage

area network, wherein the master port is adapted for managing lock requests;

wherein (b), (c), (d) and (e) are performed by a dedicated processor that is dedicated to only said port of the network device.

2. (Cancelled)

3. (Cancelled)

4. (Cancelled)

5. (Original) The method as recited in claim 1, wherein the frame or packet received at the port of the network device is a fibre channel frame.

6. (Original) The method as recited in claim 1, wherein the frame received at the port of the network device is an iSCSI frame.

7. (Cancelled)

8. (Original) The method as recited in claim 1, wherein the frame or packet received at the port of the network device comprises a SCSI read or write command.

9. (Original) The method as recited in claim 1, wherein determining that the frame or packet pertains to access of a virtual storage location comprises identifying an address of the virtual storage unit in the frame or packet from the initiator.

10. (Original) The method as recited in claim 9, wherein the address is a destination address.

11. (Original) The method as recited in claim 1, wherein determining that the frame or packet pertains to access of a virtual storage location comprises identifying an address of the port in a destination address field of the frame or packet from the target.

12. (Previously Presented) The network device as recited in claim 56, wherein the virtual storage unit is a virtual logical unit and the one or more physical storage units are physical logical units.

13. (Original) The method as recited in claim 1, wherein the virtual-physical mapping is defined by a virtualization model.

14. (Original) The method as recited in claim 1, the method further comprising: generating one or more new packets or frames or modifying the received packet or frame in a manner that replaces a destination address of the virtual storage unit with one or more destination addresses of the one or more physical storage units.

15. (Original) The method as recited in claim 1, the method further comprising: generating a new packet or frame or modifying the received packet or frame in a manner that replaces a source address of a physical storage unit with a source address of the virtual storage unit.

16. (Original) The method as recited in claim 1, the method further comprising:

generating a new packet or frame or modifying the received packet or frame in a manner that replaces a source address of the initiator with an address of the port on the network device.

17. (Previously Presented) The network device as recited in claim 56, at least one of the processor or the memory being further adapted for:

generating a new packet or frame or modifying the received packet or frame in a manner that replaces a destination address of the port on the network device with a destination address of the virtual storage unit.

18. (Cancelled)

19. (Cancelled)

20. (Cancelled)

21. (Cancelled)

22. (Currently Amended) The network device as recited in claim 56 24, at least one of the processor or the memory being further adapted for:

receiving a lock grant from the master port of the network device within the storage area network.

23. (Previously Presented) The network device as recited in claim 22, wherein the granted lock indicates that at least one of exclusive read or write access to the virtual storage

location is granted.

24. (Previously Presented) The network device as recited in claim 22, at least one of the processor or the memory being further adapted for:

sending a transfer ready message to the initiator when the lock grant is received.

25. (Previously Presented) The network device as recited in claim 22, at least one of the processor or the memory being further adapted for:

requesting a release of the granted lock from the master port of the network device within the storage area network.

26. (Previously Presented) The network device as recited in claim 25, at least one of the processor or the memory being further adapted for:

receiving a notification that the granted lock has been released by the master port.

27. (Previously Presented) The network device as recited in claim 25, wherein requesting a release of the granted lock is performed when the read or write command has been successfully completed.

28. (Previously Presented) The network device as recited in claim 27, wherein the command has been successfully completed when a status indicating that the command was successful is received from the initiator or the target.

29. (Original) The method as recited in claim 1, wherein the frame or packet received at a port of the network device comprises a read or write command indicating an amount of

memory to be read or written to, the method further comprising:

allocating the amount of memory at the network device.

30. (Original) The method as recited in claim 29, further comprising:

receiving a status from the target after the sending of the new or modified frame or packet to the target; and

when the status indicates that the command was successful, de-allocating the amount of memory at the network device.

31. (Original) The method as recited in claim 1, wherein the frame or packet received at a port of the network device comprises a read or write command, the method further comprising:

receiving a transfer ready signal from the target after the sending of the new or modified frame or packet, the transfer ready signal indicating that the target is ready to receive a transfer of data.

32. (Original) The method as recited in claim 31, further comprising:

sending a transfer ready signal to the initiator after the sending of the new or modified frame or packet, the transfer ready signal indicating that the network device is ready to receive a transfer of data from the initiator;

wherein sending the transfer ready signal to the initiator is performed prior to receiving a transfer ready signal from the target.

33. (Original) The method as recited in claim 1, wherein the frame or packet received at a port of the network device comprises a read or write command, the method further

comprising:

receiving a status after the sending of the new or modified frame or packet, the status indicating whether the command was successful.

34. (Original) The method as recited in claim 33, further comprising:

sending the status to the initiator.

35. (Original) The method as recited in claim 33, further comprising:

sending a second new or modified frame or packet to an initiator or a target specified by the virtual-physical mapping;

receiving a second status after the sending of the second new or modified frame or packet, the second status indicating whether the command was successful;

merging the status and the second status; and

sending the merged status to the initiator.

36. (Original) The method as recited in claim 33, further comprising:

determining from the status whether the command was successful; and

re-sending the new or modified frame or packet when it is determined that the command was not successful.

37. (Original) The method as recited in claim 36, further comprising:

sending the status to the initiator when it is determined that the command was successful.

38. (Original) The method as recited in claim 36, wherein the new or modified frame

or packet comprises data.

39. (Original) The method as recited in claim 36, wherein the new or modified frame or packet comprises a read or write command.

40. (Original) The method as recited in claim 36, wherein the frame or packet received at a port of the network device comprises data, the method further comprising:
storing the data in a memory location;
wherein re-sending the new or modified frame or packet comprises:
obtaining the data from the memory location; and
sending a new or modified frame or packet including the obtained data to the initiator or the target specified by the virtual-physical mapping.

41. (Original) The method as recited in claim 36, further comprising:
receiving data from the target specified by the virtual-physical mapping; and
storing the data in a memory location.

42. (Original) The method as recited in claim 41, wherein re-sending the new or modified frame or packet comprises:
obtaining the data from the memory location; and
sending a new or modified frame or packet including the obtained data to the initiator specified by the virtual-physical mapping.

43. (Original) The method as recited in claim 41, wherein re-sending the new or modified frame or packet comprises sending the new or modified frame or packet to an

alternate target specified by the virtual-physical mapping, the method further comprising:

receiving alternate data from the alternate target specified by the virtual-physical mapping; and

comparing the alternate data with the data stored in the memory location.

44. (Original) The method as recited in claim 43, further comprising:

employing a mirror algorithm to select the alternate target.

45. (Previously Presented) The network device as recited in claim 56, wherein the frame or packet received at the port of the network device and the new or modified frame or packet sent by the network device are compatible with a standard protocol.

46. (Previously Presented) The network device as recited in claim 45, wherein the standard protocol is SCSI.

47. (Previously Presented) The network device as recited in claim 45, wherein the frame or packet received at the port of the network device and the new or modified frame or packet sent by the network device are compatible with a type of traffic to be carried by the frames or packets.

48. (Previously Presented) The network device as recited in claim 47, wherein the type of traffic is fibre channel.

49. (Previously Presented) The network device as recited in claim 47, wherein the type of traffic is iSCSI.

50. (Original) The method as recited in claim 1, wherein the frame or packet received at the port of the network device comprises a SCSI read command and the new or modified frame or packet sent by the network device comprises a SCSI read command.

51. (Original) The method as recited in claim 1, wherein the frame or packet received at the port of the network device comprises a SCSI write command and the new or modified frame or packet sent by the network device comprises a SCSI write command.

52. (Previously Presented) The network device as recited in claim 56, wherein the frame or packet received at the port of the network device comprises a read command and the new or modified frame or packet sent by the network device comprises a read command.

53. (Previously Presented) The network device as recited in claim 56, wherein the frame or packet received at the port of the network device comprises a write command and the new or modified frame or packet sent by the network device comprises a write command.

54. (Currently Amended) A computer-readable medium storing thereon instructions for implementing storage virtualization on a network device of a storage area network, the computer-readable medium comprising:

(a) instructions for receiving a frame or packet at a port of the network device, wherein the network device is a switch, router, iSCSI gateway, or other network node configured to perform a switching function, wherein the frame or packet received at the port of the network device includes a read or write command;

(b) instructions for determining that the frame or packet pertains to access of a virtual

storage location of a virtual storage unit representing one or more physical storage locations on one or more physical storage units of the storage area network, wherein the virtual storage unit comprises a VLUN or other virtual representation of storage on the storage area network;

- (c) instructions for obtaining a virtual-physical mapping between the one or more physical storage locations and the virtual storage location;
- (d) instructions for sending a new or modified frame or packet to an initiator or a target specified by the virtual-physical mapping; and
- (e) instructions for requesting a lock of the one or more physical storage locations by said port of the network device prior to submitting a read or write command to the one or more physical storage locations, wherein requesting a lock of the one or more physical storage locations includes sending a lock request to a single master port of a network device within the storage area network, wherein the master port is adapted for managing lock requests;

wherein (b), (c), (d) and (e) are performed by a dedicated processor that is dedicated to only said port of the network device.

55. (Currently Amended) A network device of a storage area network adapted for implementing storage virtualization, comprising:

- (a) means for receiving a frame or packet at a port of the network device, wherein the network device is a switch, router, iSCSI gateway, or other network node configured to perform a switching function, wherein the frame or packet received at the port of the network device includes a read or write command;
- (b) means for determining that the frame or packet pertains to access of a virtual storage location of a virtual storage unit representing one or more physical storage locations on one or more physical storage units of the storage area network, wherein the virtual storage

unit comprises a VLUN or other virtual representation of storage on the storage area network;

(c) means for obtaining a virtual-physical mapping between the one or more physical storage locations and the virtual storage location;

(d) means for sending a new or modified frame or packet to an initiator or a target specified by the virtual-physical mapping; and

(e) means for requesting a lock of the one or more physical storage locations by said port of the network device prior to submitting a read or write command to the one or more physical storage locations, wherein requesting a lock of the one or more physical storage locations includes sending a lock request to a single master port of a network device within the storage area network, wherein the master port is adapted for managing lock requests; wherein (b), (c), (d) and (e) are performed by a dedicated processor that is dedicated to only said port of the network device.

56. (Currently Amended) A network device of a storage area network adapted for implementing storage virtualization, comprising:

a processor; and

a memory, at least one of the processor or the memory being adapted for:

(a) receiving a frame or packet at a port of the network device, wherein the network device is a switch, router, iSCSI gateway, or other network node configured to perform a switching function, wherein the frame or packet received at the port of the network device includes a read or write command;

(b) determining that the frame or packet pertains to access of a virtual storage location of a virtual storage unit representing one or more physical storage locations on one or more physical storage units of the storage area network, wherein the virtual storage unit comprises a VLUN or other virtual representation of storage on the storage area network;

(c) obtaining a virtual-physical mapping between the one or more physical storage locations and the virtual storage location;

(d) sending a new or modified frame or packet to an initiator or a target specified by the virtual-physical mapping; and

(e) requesting a lock of the one or more physical storage locations by said port of the network device prior to submitting a read or write command to the one or more physical storage locations, wherein requesting a lock of the one or more physical storage locations includes sending a lock request to a single master port of a network device within the storage area network, wherein the master port is adapted for managing lock requests; wherein (b), (c), (d) and (e) are performed by a dedicated processor that is dedicated to only said port of the network device.

57. (Currently Amended) A network device for use in a storage area network supporting virtualization, the network device including a plurality of ports, wherein at least some of said ports comprise

(i) an interface for sending and receiving packets or frames on a storage area network, wherein the network device is a switch, router, iSCSI gateway, or other network node configured to perform a switching function; and

(ii) logic dedicated to and implemented by said port of the network device, said logic for

identifying frames or packets pertaining to access of a virtual storage location of a virtual storage unit representing one or more physical storage locations on one or more physical storage units of the storage area network, wherein the virtual storage unit comprises a VLUN or other virtual representation of storage on the storage area network;

implementing a virtual-physical mapping between the one or more physical

storage locations and the virtual storage location; and

requesting a lock of the one or more physical storage locations by said port of the network device prior to submitting a read or write command to the one or more physical storage locations, wherein requesting a lock of the one or more physical storage locations includes sending a lock request to a single master port of a network device within the storage area network, wherein the master port is adapted for managing lock requests;

wherein said logic is implemented by a dedicated processor that is dedicated to only said port of the network device.

58. (Currently Amended) A method of implementing storage virtualization on a network device of a storage area network, the method comprising:

(a) receiving a frame or packet at a port of the network device, wherein the network device is a switch, router, iSCSI gateway, or other network node configured to perform a switching function, wherein the frame or packet received at the port of the network device includes a read or write command;

(b) obtaining information from the frame or packet pertaining to access of data stored in one or more physical locations on one or more physical storage units of the storage area network, the information identifying one or more of the physical locations or a virtual storage location of a virtual storage unit, the virtual storage location representing the one or more physical storage locations, wherein the virtual storage unit comprises a VLUN or other virtual representation of storage on the storage area network;

(c) obtaining a virtual-physical mapping between the one or more physical storage locations and the virtual storage location;

(d) sending a new or modified frame or packet to an identity specified by the virtual-physical mapping; and

(e) requesting a lock of the one or more physical storage locations by said port of the network device prior to submitting a read or write command to the one or more physical storage locations, wherein requesting a lock of the one or more physical storage locations includes sending a lock request to a single master port of a network device within the storage area network, wherein the master port is adapted for managing lock requests;

wherein (b), (c), (d) and (e) are performed by a dedicated processor that is dedicated to only said port of the network device.

59. (Previously Presented) The method as recited in claim 58, wherein the new or modified frame or packet includes at least one of a source address or destination address obtained from the virtual-physical mapping.

60. (Original) The method as recited in claim 58, wherein the received frame or packet includes a source address and destination address, and wherein the obtained information includes at least one of the source address and the destination address.

61. (Previously Presented) The network device as recited in claim 21, wherein sending a lock request further comprises:

 sending a lock request to a master port of a switch, router, iSCSI gateway, or other network node configured to perform a switching function.

62. (Previously Presented) The network device as recited in claim 20, wherein the single master port is not accessing the one or more physical storage locations.

63. (Previously Presented) The network device as recited in claim 20, wherein the single master port is not reading data from or writing data to the one or more physical storage locations.